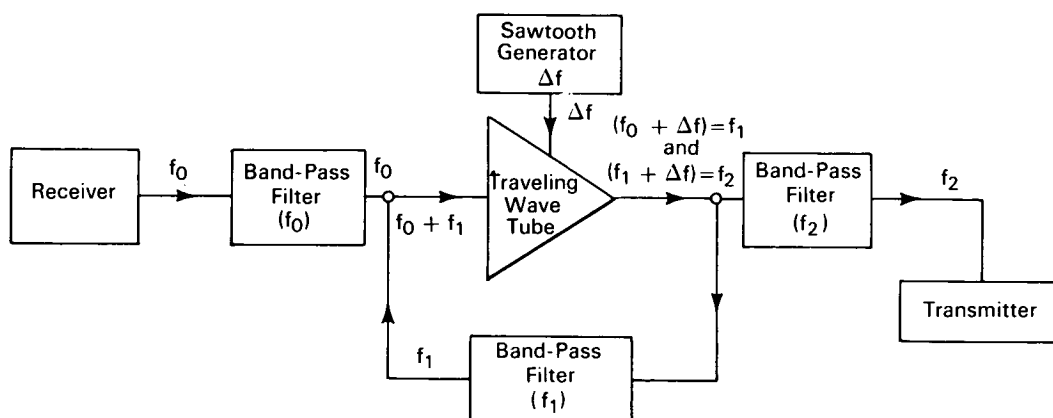


NASA TECH BRIEF



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Traveling-Wave Tube Circuit Simplifies Microwave Relay



The problem: Long-distance microwave communication systems generally require signal amplification at active-repeater relay stations along the transmission path. To prevent feedback oscillations in the relay amplifier, the incoming microwave signal must be converted to a different microwave frequency for transmission. This conversion, usually accomplished by converting the incoming signal to an intermediate frequency which is then amplified and converted to a new microwave signal, has required a fairly complex system, consisting of a preselector, mixers, a local oscillator, amplifiers, and filters.

The solution: A circuit employing a sawtooth-modulated traveling-wave tube, which serves both as a frequency converter and as an amplifier.

How it's done: The microwave input signal at frequency f_0 is coupled by an f_0 band-pass filter to the sawtooth-modulated (frequency Δf) traveling-wave tube, where transit-time modulation of the signal takes place. When the slope of the sawtooth modulating

signal is positive, the output from the traveling-wave tube comprises signals of frequency f_1 (equal to $f_0 + \Delta f$) and f_2 (equal to $f_1 + \Delta f$), respectively. These signals are coupled to two band-pass filters tuned to frequency f_1 and f_2 , respectively. The output from the f_1 band-pass filter is coupled back to the input of the traveling-wave tube. The output from the f_2 band-pass filter is then a twice-amplified microwave signal at frequency f_2 , which is transmitted by the system.

Notes:

1. Lower power losses and reduced size and weight are realized in this circuit, because it eliminates separate rf mixers and uses fewer filters than required in previous designs.
2. Inquiries concerning this invention may be directed to:

Technology Utilization Officer
Goddard Space Flight Center
Greenbelt, Maryland, 20771
Reference: B65-10127

(continued overleaf)

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